

CLAIMS

We Claim:

1. A ground-based system for tracking and warning aircraft, comprising:

means for tracking at least one aircraft to determine aircraft position and altitude;

means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned; and

means for warning the at least one aircraft.

2. The system of claim 1, wherein the means for tracking comprises a 3-D multilateration system for determining aircraft position and altitude.

3. The system of claim 1, wherein the means for tracking comprises a 2-D multilateration system for determining aircraft position and a means for receiving transponder data to determine aircraft altitude.

4. The system of claim 1, wherein the means for tracking comprises an active radar system.

5. The system of claim 1, wherein the means for tracking comprises a passive radar system.

6. The system of claim 2, wherein the 3-D multilateration system determines aircraft position, altitude, track and speed.

7. The system of claim 3, wherein the 2-D multilateration system determines aircraft position, track, and speed.

8. The system of claim 1, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position and altitude to a minimum safe altitude profile and determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that

of a minimum safe altitude for the position of the at least one aircraft.

9. The system of claim 1, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft and determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at least one aircraft are within a predetermined range of one another.

10. The system of claim 1; wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position and altitude to an airport noise profile and determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

11. The system of claim 1, wherein the means for warning the at least one aircraft comprises a means for generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

12. The system of claim 1, wherein the means for warning the at least one aircraft comprises a means for generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

13. The system of claim 13, wherein the means for warning the at least one aircraft comprises a digital data link to the aircraft, wherein digital warning data are broadcast to the aircraft from the ground, and the digital warning data is displayed on an aircraft cockpit display.

14. The system of claim 2, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be

warned comprises means for comparing the at least one aircraft position and altitude to a minimum safe altitude profile and determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

15. The system of claim 2, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft and determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at least one aircraft are within a predetermined range of one another.

16. The system of claim 2, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft

position and altitude to an airport noise profile and determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

17. The system of claim 2, wherein the means for warning the at least one aircraft comprises a means for generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

18. The system of claim 2, wherein the means for warning the at least one aircraft comprises a means for generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

19. The system of claim 18, wherein the means for warning the at least one aircraft comprises a digital data link to the aircraft, wherein digital warning data are broadcast to the aircraft from the ground, and the digital warning data is displayed on an aircraft cockpit display.

20. The system of claim 3, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position and altitude to a minimum safe altitude profile and determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

21. The system of claim 3, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft and determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at least one aircraft are within a predetermined range of one another.

22. The system of claim 3, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position and altitude to an airport noise profile and determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

23. The system of claim 3, wherein the means for warning the at least one aircraft comprises a means for generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

24. The system of claim 3, wherein the means for warning the at least one aircraft comprises a means for generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

25. The system of claim 14, wherein the means for warning the at least one aircraft comprises a digital data link to the



aircraft, wherein digital warning data are broadcast to the aircraft from the ground, and the digital warning data is displayed on an aircraft cockpit display.

26. The system of claim 6, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position, altitude and track to a minimum safe altitude profile and determining that the at least one aircraft should be warned if the position, altitude, and track of the at least one aircraft indicates that the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

27. The system of claim 6, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the position, altitude, and track of a first of the at least one aircraft with the position, and altitude, and track of a second of at least one aircraft and determining that the at least one aircraft should be warned if the

position, altitude, and track of the first of the at least one aircraft and the position, altitude, and track of the second of the at least one aircraft are within a predetermined range of one another or on course to come within a predetermined range of one another.

28. The system of claim 6, wherein the means for comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises means for comparing the at least one aircraft position, altitude, and track to an airport noise profile and determining that the at least one aircraft should be warned if the position, altitude, and track indicate that the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

29. The system of claim 6, wherein the means for warning the at least one aircraft comprises a means for generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

30. The system of claim 6, wherein the means for warning the at least one aircraft comprises a means for generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

31. The system of claim 30, wherein the means for warning the at least one aircraft comprises a digital data link to the aircraft, wherein digital warning data are broadcast to the aircraft from the ground, and the digital warning data is displayed on an aircraft cockpit display.

32. A ground-based method for tracking and warning aircraft, comprising the steps of:

tracking at least one aircraft to determine aircraft position and altitude,

comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned, and

warning the at least one aircraft.

33. The method of claim 32, wherein said step of tracking comprises 3-D multilateration to determine aircraft position and altitude.

34. The method of claim 32, wherein said step of tracking comprises 2-D multilateration to determine aircraft position and a receiving transponder data to determine aircraft altitude.

35. The method of claim 32, wherein said step of tracking comprises the step of tracking using active radar.

36. The method of claim 32, wherein said step of tracking comprises the step of tracking using passive radar.

37. The method of claim 33, wherein the step of 3-D multilateration determines aircraft position, altitude, track and speed.

38. The method of claim 34, wherein the step of 2-D multilateration determines aircraft position, track, and speed.

39. The method of claim 32, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to a minimum safe altitude profile, and

determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

40. The method of claim 32, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft, and

determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at least one aircraft are within a predetermined range of one another.

41. The method of claim 32, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to an airport noise profile, and

determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

42. The method of claim 32, wherein said step of warning the at least one aircraft comprises the step of generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

43. The method of claim 32, wherein said step of warning the at least one aircraft comprises the step of generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

44. The method of claim 43, wherein said step of warning the at least one aircraft comprises the steps of:

transmitting, over a digital data link, digital warning data to the aircraft from the ground, and

displaying the digital warning data on an aircraft cockpit display.

45. The method of claim 33, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to a minimum safe altitude profile, and

determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

46. The method of claim 33, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft, and

determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at least one aircraft are within a predetermined range of one another.

47. The method of claim 33, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to an airport noise profile, and



determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

48. The method of claim 33, wherein said step of warning the at least one aircraft comprises the step of generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

49. The method of claim 33, wherein said step of warning the at least one aircraft comprises the step of generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

50. The method of claim 49, wherein said step of warning the at least one aircraft comprises the steps of:

transmitting, over a digital data link, digital warning data to the aircraft from the ground, and

displaying the digital warning data on an aircraft cockpit display.

51. The method of claim 34, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to a minimum safe altitude profile, and

determining that the at least one aircraft should be warned if the altitude of the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

52. The method of claim 34, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the position and altitude of a first of the at least one aircraft with the position and altitude of a second of at least one aircraft, and

determining that the at least one aircraft should be warned if the position and altitude of the first of the at least one aircraft and the position and altitude of the second of the at

least one aircraft are within a predetermined range of one another.

53. The method of claim 34, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position and altitude to an airport noise profile, and

determining that the at least one aircraft should be warned if the position and altitude of the at least one aircraft is approaching or exceeding a boundary of the airport noise profile.

54. The method of claim 34, wherein said step of warning the at least one aircraft comprises the step of generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

55. The method of claim 34, wherein said step of warning the at least one aircraft comprises the step of generating a visual

message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

56. The method of claim 55, wherein said step of warning the at least one aircraft comprises the steps of:

transmitting, over a digital data link, digital warning data to the aircraft from the ground, and

displaying the digital warning data on an aircraft cockpit display.

57. The method of claim 37, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position, altitude and track to a minimum safe altitude profile, and

determining that the at least one aircraft should be warned if the position, altitude, and track of the at least one aircraft indicates that the at least one aircraft is approaching or below that of a minimum safe altitude for the position of the at least one aircraft.

58. The method of claim 37, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the position, altitude, and track of a first of the at least one aircraft with the position, and altitude, and track of a second of at least one aircraft, and

determining that the at least one aircraft should be warned if the position, altitude, and track of the first of the at least one aircraft and the position, altitude, and track of the second of the at least one aircraft are within a predetermined range of one another or on course to come within a predetermined range of one another.

59. The method of claim 37, wherein said step of comparing aircraft position and altitude to at least one predetermined criteria to determine whether the at least aircraft should be warned comprises the steps of:

comparing the at least one aircraft position, altitude, and track to an airport noise profile, and

determining that the at least one aircraft should be warned if the position, altitude, and track indicate that the at least

one aircraft is approaching or exceeding a boundary of the airport noise profile.

60. The method of claim 37, wherein said step of warning the at least one aircraft comprises the step of generating an audio radio message to the at least one aircraft so that a pilot of the at least one aircraft is audibly warned.

61. The method of claim 37, wherein said step of warning the at least one aircraft comprises the step of generating a visual message to the at least one aircraft so that a pilot of the at least one aircraft is visually warned.

62. The method of claim 61, wherein said step of warning the at least one aircraft comprises the steps of:

transmitting, over a digital data link, digital warning data to the aircraft from the ground, and

displaying the digital warning data on an aircraft cockpit display.